

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: March 6, 1952

Released: March 12, 1952

UNITED AIR LINES, INC., NEAR OAKLAND, CALIFORNIA, AUGUST 24, 1951

THE ACCIDENT

United Air Lines' Flight 615 of August 23, 1951, a Douglas DC-6B, N-37550, crashed at approximately 0428¹ on August 24, 1951, near the top of a hill while approaching the Oakland, California, Municipal Airport for landing. The impact site was 14.8 statute miles and on a true bearing of 123 degrees from the Oakland Airport. All 44 passengers and six crew members were killed instantly and the aircraft was demolished.

HISTORY OF THE FLIGHT

Flight 615 departed Boston, Massachusetts, at 1732 EST, August 23, 1951, made scheduled stops at Hartford, Connecticut, and Cleveland, Ohio, and arrived at Chicago, Illinois, at 2159 CST. The flight between Boston and Chicago was routine and no malfunctions of equipment were reported. Inspection of the aircraft by ground crew personnel at Chicago also failed to reveal any mechanical or radio discrepancies. A crew change was made at Chicago.

The flight departed Chicago at 2259 CST with crew members Captain Marion W. Hedden, First Officer George A. Jewett, Flight Engineer Mario A. Durante, Assistant Chief Flight Engineer Arthur W. Kessler, and Stewardesses Marilyn Murphy and LaVerne Sholes. There were 44 passengers, two of whom were infants, 3,830 gallons of fuel, and 5,360 pounds of mail, air express, and baggage. Gross weight of the aircraft upon departure was 95,215 pounds, which was 4,785 pounds less than the allowable gross take-off weight of 100,000 pounds. The load was properly distributed with relation to the center of gravity of the aircraft.

Air Route Traffic Control (ARTC) cleared Flight 615 on an instrument flight plan from Chicago to Oakland, and from Oakland to San Francisco in accordance with Visual Flight Rules (VFR). Altitude was to be 18,000 feet mean sea level (MSL) via Fed Airway 4, Green Airway 3, and Fed Airway 6 from Chicago to Denver, direct to Milford, Utah, and thence direct to Oakland. Flight between Oakland and San Francisco was to have been via Green Airway 3 at 500 feet.

Routine radio contacts were made en route. At 0354, August 24, while approaching the Oakland area, Flight 615 was cleared to the Newark, California fan marker, with instructions to descend to 6,000 feet, maintain that altitude, and contact Oakland Approach Control over Altamont, California. At 0411, the flight reported over Stockton, California, at 9,500 feet, descending. At this time the flight was given, and acknowledged, the Oakland altimeter setting of 29.88 inches.

Flight 615 reported over the Altamont Intersection at 0416, and made initial contact with Oakland Approach Control one-half minute later. Clearance of the flight into Oakland was now vested in Approach Control, and no further radio contacts were made with company communications. The flight was cleared by Approach Control to the Oakland radio range station to maintain at least 500 feet above the tops of the clouds. The pilot followed this contact with a request for clearance direct to Newark and a straight-in range approach. The Newark fan marker and compass locator lie on the southeast leg of the Oakland radio range. This request was granted, with instructions to maintain an altitude of 500 feet on top of the cloud layer between Altamont and Newark. At 0422, the flight reported approaching the Hayward, California, compass locator, which is between Newark and Altamont, and requested a second modification to clearance instructions by asking for a straight-in ILS (Instrument

¹ All times referred to herein are Pacific Standard, unless otherwise noted, and based on the 24-hour clock.

Landing System) approach² Approach Control advised it to stand by due to another aircraft in the area. Flight 615 shortly thereafter advised Approach Control that it was approaching Newark and to disregard the request for an ILS approach.

At 0425 Flight 615 was cleared for a straight-in approach on the southeast course of the Oakland radio range from Newark. At 0427 the flight reported leaving Newark inbound to Oakland. This was the last radio contact. The aircraft struck the hill at approximately 0428 and was demolished.

INVESTIGATION

The aircraft struck in rising mountainous terrain at 983 feet MSL, 26 feet below the crest of the hill, and on a magnetic heading of approximately 296 degrees. An eye witness reported that it was on a straight course, but descending, just before impact. The descent was verified by the fact that the next hill to the south, over which the flight passed, is higher than the one struck. The major portion of the structure hurtled over the top of the knoll, scattering on the down-slope and into a canyon beyond. Wreckage was distributed over an area approximately 1,640 feet in length and 900 feet in width. A gasoline and grass fire flared upon impact, extending over the knoll, down-slope, and into the canyon. There was no evidence found of fire prior to impact.

The main landing gear was extended at the time, and reasonable proof exists that the nose wheel was retracted, or nearly retracted. The main landing gear on this model extends before the nose gear and retracts after it. Wing flaps were between the fully retracted and 30 degrees extended position. All four engines were producing substantial power at the time of impact. Examination of propeller blade cuts in the earth and blade index settings showed that the blades were in the forward thrust range. Evidence indicated that the ground speed upon impact was between 225 and 240 miles per hour.

Examination of the two ADF (Automatic Direction Finder) radio receivers revealed

that the captain's was tuned to the Newark compass locator, with volume control approximately one-third ON, function switch on the ADF position, and the pointer position at 253 degrees relative to the heading of the aircraft. The first officer's receiver was tuned to the Hayward compass locator, the function switch was on the ADF position, pointer position at 28 degrees relative to the aircraft's final heading, and the volume control was in the OFF position. This latter pointer position approximates the bearing to the Hayward station from the impact site. With these two low-frequency receivers in use, there was no other apparatus available to receive the Oakland radio range.

It was not possible to determine the setting of the VHF (Very High Frequency) unit used by the flight for communicating with Oakland Approach Control, however, the switch was in the ON position with the volume control turned to between one-third and one-half of full value.

Parts of both altimeters were found. The captain's altimeter indicated 930 feet, the crash site was at 983 feet MSL. The setting on the first officer's altimeter was 29 90 inches, which closely approximated the Oakland altimeter setting of 29 88 inches as transmitted to, and acknowledged, by the flight.

The dial and head of one Master Direction Indicator was locked at a magnetic heading of about 300 degrees. The card of the magnetic compass showed that the compass heading at impact was between 305 and 310 degrees. No information could be obtained from the turn and bank, rate of climb, air speed, and flap position indicators. Neither could it be determined whether the automatic pilot was in use.

Detailed examination of structural, electrical, radio, and powerplant components revealed no evidence of failure or malfunctioning which might have caused or contributed to the accident.

Weather in the San Francisco Bay area on August 24 was generally of the type characteristic of this area during summer. Low stratus clouds had developed along the coast in a shallow layer of cool moist maritime air. All reports in the Bay region between 0400 and 0530 gave ceilings between 1,000 and 1,500 feet with visibility beneath the clouds of six miles or better. There were breaks in

² ILS approaches may not be initiated from any point between Altamont and Newark, the only two points from which an ILS approach may be instituted are Oakland or Newark, thence to Hayward, from which point the approach may be started.

the overcast during this period. Winds were light, less than 10 knots, and were too low to have caused erroneous altimeter readings. There was little or no turbulence. There could have been no icing since the freezing level was near 13,000 feet. Between Altamont Intersection and Newark the flight passed over nearly solid stratus clouds between 800 and 1,000 feet thick. Lights from the towns of Niles, Centerville, and Newark, all in the vicinity of the crash, should have glowed through the overcast, and perhaps could have been seen through the holes in the stratus formation. The crash occurred during morning twilight, and some light was also available from the moon. As Flight 615 broke out under the stratus at about 1,500 feet, downward visibility was possible, but ground objects and contours were probably difficult to recognize and identify. For this reason, it is believed that weather conditions were closer to Instrument Flight Rules (IFR) than VFR at the time of the accident.

Three witnesses saw the flight in the vicinity of Newark. They stated that it was flying in and out of low clouds and noted nothing abnormal except that it was low. The impact site was shrouded in wisps of fog. Other persons heard, but did not see, a low-flying aircraft and were therefore unable to identify it as Flight 615.

A flight was made on August 30, 1951, using another United Air Lines DC-6B,³ in an attempt to simulate the last portion of the subject flight. It was flown by UAL pilots with CAB and CAA observers. Two runs were made from the Altamont Intersection to the Newark compass locator and thence to the impact site. Also, three runs were made over the reconstructed flight path from south-southwest of the town of Newark to the accident scene. All of the ground witnesses were stationed with investigators at the spot where they observed Flight 615. CAA two-way mobile radio units were placed at two of these locations so that instructions could be transmitted to the test aircraft, adjusting the flight's path and altitude in accordance with recollections of the witnesses. The indicated air speed during the five runs was maintained at between 190 and 200 miles per hour, the normal speed for the configuration probably used by Flight 615. Since the

elapsed flight time for Flight 615 from the Altamont Intersection to the impact site was a total of 12 minutes, and the most probable flight path took 13 minutes and 10 seconds, it was felt that this reconstruction was within allowable tolerances.

The test aircraft flew direct to Newark from the Altamont Intersection using the Hayward and Newark compass locators on the two ADF's. Descent was begun prior to leaving Altamont Intersection, crossing there at 6,000 feet. This was the same altitude reported by Flight 615 and an indicated air speed of 250 miles per hour was used in the check flight descent. The Newark compass locator was crossed at 3,000 feet. Continuing past the station to south of Newark, a left turn was made in such a manner that the aircraft could be headed toward the Newark compass locator station on a magnetic heading of approximately 350 degrees. The resultant path from this location was obtained through the combined observations of the witnesses. The maneuvering of Flight 615 in the Newark area was probably at some altitude between 1,500 and 2,000 feet throughout the known pattern. It was found that no abrupt maneuvers were necessary in reconstruction of the flight path. Normal angles of bank were used on all turns.

Instrument approach procedures for the Newark area require an aircraft on an IFR flight plan to maintain an altitude of not less than 3,500 feet until it has left Newark inbound to Oakland on the southeast course of the Oakland radio range. Should the aircraft be holding at Newark on the standard race-track holding pattern to the southeast of the radio facility, the minimum IFR altitude would be 4,500 feet. Since the flight did not cancel its IFR clearance and advise Approach Control that it was contact, nor had it received instructions to hold, the minimum altitude permissible until leaving Newark inbound to Oakland would therefore have been 3,500 feet.

All pertinent maintenance records for N-37550 were reviewed but no items were found which would be significant to the accident or would show that the aircraft was in any way unairworthy.

Because of the possibility of abnormal operation of navigational facilities at the time of the accident, all pertinent radio

³ See Attachment

facilities in the area were either flight checked by the CAA later in the day, or had been automatically monitored during the period of the accident. All facilities were found to have been operating normally.

Company records reflected that Captain Hedden and First Officer Jewett, who both held air transport ratings, had extensive flight experience in the Oakland-San Francisco area. Captain Hedden had logged over 400 hours in DC-6's and Mr. Jewett over 2,800. Since the DC-6B had only recently been placed into service by United Air Lines, neither pilot had extensive flight time in it. Captain Hedden had less than 14 hours, and Mr. Jewett approximately 21 hours. Both had satisfactorily completed transitional training for the DC-6B, which has nearly the same flight characteristics and cockpit arrangement as the DC-6.

ANALYSIS

Examination of the wreckage indicated that there was no in-flight failure, likewise, maintenance records failed to reveal any discrepancies which would have caused the accident. Also, no weather conditions existed which would suggest that the aircraft encountered unusual weather phenomena. There was no indication from the flight itself that everything was other than routine.

It should be noted that all witnesses stated the aircraft was flying at low altitude in the Newark area and reconstruction of the flight path indicated the altitude was in the neighborhood of 1,500 to 2,000 feet prior to the final, straight descent. It has been pointed out that the flight was still on an IFR flight plan at the time it crashed, and the minimum prescribed altitude prior to leaving Newark is 3,500 feet. Flight 615 was neither at least 500 feet above the top of the stratus layer nor adhering to the minimum altitude of 3,500 feet as it maneuvered awaiting clearance to Oakland. Witnesses reported that it was below, or just skirting, the lower side of the clouds.

The aircraft was equipped with two low-frequency receivers, neither of which was tuned to the Oakland radio range station. There was no evidence to indicate which pilot was flying the aircraft. Any conclusions regarding the courses of action which they took, or why navigational facilities were not properly utilized must necessarily be conjectural.

Had the flight proceeded on the course indicated by the probable flight path, it would have passed near the Hayward compass locator. The theory has been advanced that the pilot flying was partly in contact and was using the first officer's ADF needle as a course check. The volume control on this unit was found in the OFF position, and it is possible that the pilot thought the receiver was tuned to the Oakland radio range station. Had the volume control been turned up and the vital aural check on station identification and range been made, the pilot would have known immediately that the flight was not on-course inbound to Oakland. The needle indication alone will not show an aircraft's position relative to the range course.

A radio transmission was made by the flight one minute before the accident, advising that it was leaving Newark inbound. Final letdown to 500 feet is permissible past that point, and according to the last witness, the aircraft was descending during the time it was in his view. Plotting back one minute from the crash site, using the probable speed of the aircraft it is noted that the flight would have been slightly to the east of the town of Niles at the time the transmission was made. Niles could readily be confused with Newark under conditions of restricted visibility such as obtained at the time. The main section of Newark lies slightly to the left of the southeast course of the Oakland radio range, and occupies the same relative position with the southeast course as does Niles with the probable flight path.

The final left turn near Mission San Jose cannot be explained by any of the instrument procedures in force. By turning left from a southeast heading to northwest, the pilot may have planned to intercept the Oakland southeast course and proceed inbound. However, it will be recalled that neither of the two available radio range receivers was tuned to the Oakland radio range frequency. This turn, it is believed, was begun at about the time the flight was cleared by Approach Control for a straight-in approach.

Had the flight been conducted in accordance with the prescribed instrument procedures, this accident would not have occurred. No terrain obstructions would have been met if the flight had been at the proper altitude. Position could have been fixed on the inbound heading had the Oakland radio range been used by the flight.

During investigation of this accident, it was learned that a 500 on top clearance is interpreted by some pilots to mean 500 feet or more above the cloud tops without regard to the possibility that the resultant altitude might be less than the minimum prescribed IFR en route altitude. A CAA official testified that such a clearance does not release the pilot from conducting flight at or above the minimum en route altitude, thus providing adequate terrain clearance under all circumstances. It should be noted that although Flight 615 received such a clearance between Altamont and Newark, the altitude requirement upon reaching Newark was 4,500 feet MSL if holding or 3,500 feet MSL if continuing an approach, in accordance with prescribed instrument procedures published in Newark approach charts. The 500 feet on top clearance was therefore superseded by other altitude requirements as the aircraft passed over the Newark compass locator.

Shortly after this accident, United Air Lines made certain revisions in their Flight Operations Manual to prevent, insofar as possible, the recurrence of this type of accident. All pilots were instructed that United Air Lines' flights over the top of an overcast must be conducted in accordance with IFR and must be flown not lower than the CAA approved minimum IFR flight levels. The Manual revision further instructed them that IFR en route minimum altitudes shown in radio procedure charts must be strictly adhered to, even though the flight be operating on a clearance of at least 500 feet on top. Thus, adherence to minimum en route altitudes would always be equal to or greater than an on-top clearance should the cloud tops be lower than 500 feet below the minimum en route altitude. This included altitudes prescribed for procedure turns and those between fixes or markers. Pilots were also directed to make full use of the aural range signals during ADF or holding procedures whenever aural signals are available.

FINDINGS

On the basis of all available information, the Board finds that

- 1 The company, the aircraft, and the crew were properly certificated
- 2 The aircraft experienced no structural or power failure and was airworthy at the time of the accident
- 3 All pertinent ground radio facilities were functioning properly at the time of the accident
- 4 The aircraft was proceeding to Oakland in accordance with an instrument flight plan
- 5 The captain failed to follow the approved procedure for a straight-in range approach from Newark to Oakland by descending below the minimum altitudes for the Newark area
- 6 The flight had been cleared for a straight-in range approach, but neither receiver was tuned to the Oakland radio range station, as required
- 7 The aircraft struck a hill at an altitude of 983 feet MSL on a heading of about 296 degrees magnetic, and approximately three miles to the right of the southeast on-course signal of the Oakland radio range
- 8 Substantial power was being developed at the time of impact

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the failure of the captain to adhere to instrument procedures in the Newark area during an approach to the Oakland Municipal Airport.

BY THE CIVIL AERONAUTICS BOARD

/s/ DONALD W. NYROP
/s/ OSWALD RYAN
/s/ JOSH LEE
/s/ JOSEPH P. ADAMS
/s/ CHAN GURNEY

Supplemental Data

INVESTIGATION AND HEARING

The Civil Aeronautics Board was notified of this accident by telephone call from the Oakland Air Route Traffic Control Center at 0445 PST August 24, 1951, and investigation was immediately initiated in accordance with provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was ordered by the Board, and was held in the Leamington Hotel, 19th and Franklin Streets, Oakland, California, on September 13 and 14, 1951.

AIR CARRIER

United Air Lines, Inc., a Delaware corporation, holds a certificate of convenience and necessity issued by the Civil Aeronautics Board, authorizing the carriage of passengers and mail over a number of routes in the United States, including transcontinental Route No. 1 into Oakland, California, the route involved in this particular accident. It also holds a regular operating certificate issued by the Civil Aeronautics Administration for that route, and together with predecessor companies had been operating regular schedules over it since 1927.

FLIGHT PERSONNEL

Captain Marion W. Hedden, age 42, was employed by United Air Lines on November 1, 1939. He held a valid airman certificate with an airline transport rating. Captain Hedden had logged a total of 12,032 flying hours, of which 417 were in DC-6 and 14 were in DC-6B's, with a total of 819 hours of instrument flying time. He received his last route check on May 21, 1951, and in June 1951 accomplished a six-months instrument check, the latter being flown in the Oakland, California area. Captain Hedden qualified on the DC-6 on January 15, 1951, and on the DC-6B on April 26, 1951. He had been flying in the Oakland-San Francisco area since 1939. His last company physical examination was accomplished on April 16, 1951, and his last CAA physical on February 23, 1951.

First Officer George A. Jewett, age 35, was employed by United Air Lines on June 29, 1945. He held a valid airman certificate with an airline transport rating, and had qualified as a UAL captain in February 1949. Mr. Jewett had logged 5,842 flying hours, of which 2,848 were in DC-6 equipment, 21 in

DC-6B equipment, and 173 hours were instrument time. He accomplished an instrument flight check on February 11, 1949, and his last route check was given on May 21, 1951. Mr. Jewett qualified on the DC-6 on February 3, 1947, and on March 15, 1951, received a familiarization check-out on the DC-6B. He had flown in the Oakland-San Francisco area since August 27, 1945. His last company physical examination was accomplished on October 25, 1950, and his last CAA physical was completed on January 23, 1951.

Check Flight Engineer Arthur W. Kessler, age 43, was employed by United Air Lines on February 18, 1929. He had been acting as a flight engineer since January 20, 1944. Mr. Kessler's last CAA physical examination was accomplished on November 24, 1950, and his last company physical on October 26, 1950.

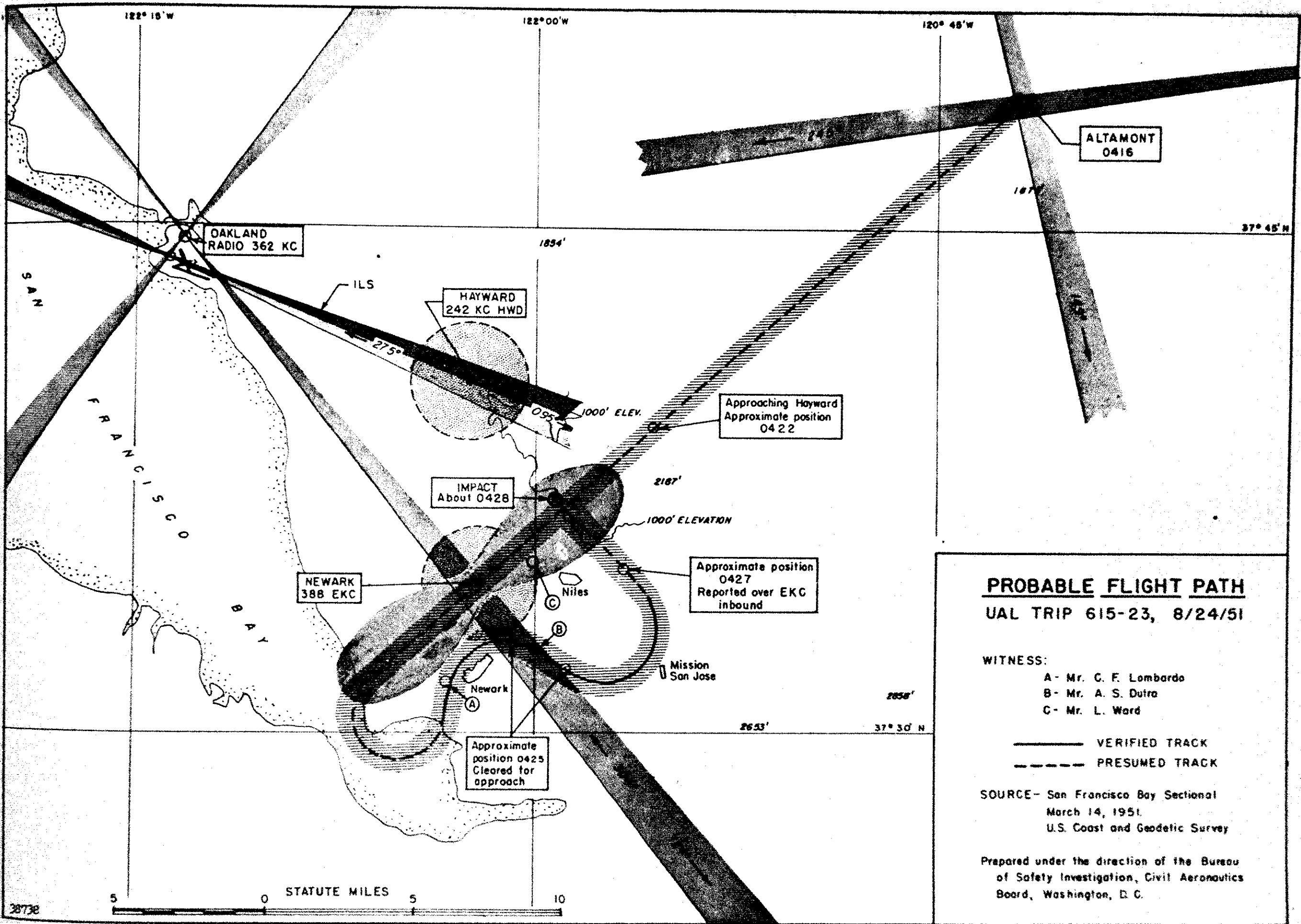
Flight Engineer Mario A. Durante, age 36, was employed by United Air Lines on April 1, 1937, as an apprentice mechanic. He was later given training as a flight engineer, and had acted in that capacity on scheduled flights since May 1, 1950. Mr. Durante had a total of 1,176 flying hours in DC-6 and DC-6B equipment. He received his last route check on November 24, 1950.

Stewardess Marilyn M. Murphy, age 24, had been employed by United Air Lines since February 29, 1949.

Stewardess La Verne M. Sholes, age 22, had been employed by United Air Lines since July 1, 1950.

THE AIRCRAFT

N-37550, a Douglas DC-6B, Serial No. 43260, was manufactured in April 1951 and was purchased by United Air Lines on April 14, 1951. At the time of the accident it had a total of 361 flying hours and was currently certificated by the CAA. Since it was a new aircraft, no engine changes or aircraft overhauls had been made. It was equipped with four Pratt & Whitney CB-16 engines and Hamilton Standard propellers. It had accumulated 40 hours since the initial 300-hour check and 7 hours following the last pre-flight inspection. Examination of all maintenance records for the aircraft reflected that it was airworthy and no items significant to the accident were found. All airworthiness directives had been accomplished on the aircraft.



PROBABLE FLIGHT PATH

UAL TRIP 615-23, 8/24/51

WITNESS:

- A - Mr. C. F. Lombardo
- B - Mr. A. S. Dutra
- C - Mr. L. Ward

—— VERIFIED TRACK
----- PRESUMED TRACK

SOURCE - San Francisco Bay Sectional
March 14, 1951
U.S. Coast and Geodetic Survey

Prepared under the direction of the Bureau
of Safety Investigation, Civil Aeronautics
Board, Washington, D. C.